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Alessandro Sembenelli and Paul Simpson

CONSIGLIO NAZIONALE DELLE RICERCHE

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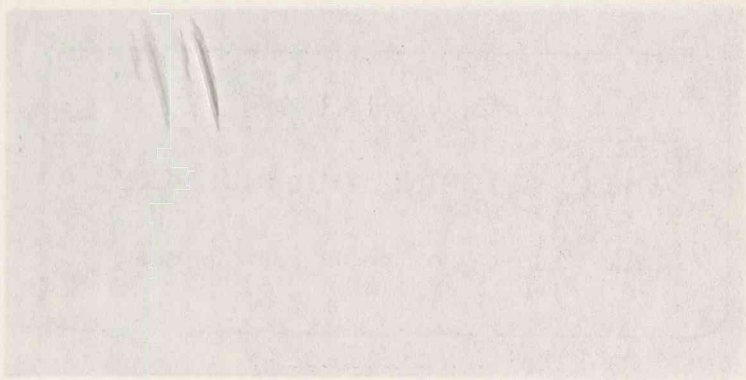

# THE UK MACHINE TOOL INDUSTRY

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***Abstract***

The UK machine tool industry has mirrored the fortunes of the rest of British industry since the early fifties. The observed decline has been both a part and a result of the weakening manufacturing base. In particular, the UK machine tool industry has suffered badly in the two recessions of the 70's and 80's. More recently the industry has shifted its strategy by favouring products which either offer the prospect of standardisation or command a premium in the market place because of their customised nature. Finally, in recent years the organisation of the industry has changed because of such phenomena as disinvestments by large engineering groups and foreign direct investment.

L'industria britannica delle macchine utensili é stata caratterizzata da un progressivo declino, analogo a quello attraversato dall'industria britannica nel suo complesso sin dagli inizi degli anni cinquanta. Con riferimento al settore analizzato, tale declino può essere considerato sia una causa sia una conseguenza del più generale arretramento delle posizioni relative al Regno Unito. In particolare l'industria britannica delle macchine utensili ha sofferto in modo accentuato durante le recessioni degli anni 70 e 80. Negli ultimi anni é in atto uno sforzo per orientare la produzione o su prodotti standardizzati o su prodotti adatti alle specifiche esigenze della clientela. Infine l'organizzazione del settore é cambiata recentemente a seguito sia dei disinvestimenti attuati dai grandi gruppi di "engineering", sia degli investimenti produttivi realizzati da imprese estere sul suolo britannico.

## 1. Introduction

Machine tools are power driven metal working machines which work metal either by cutting, forming or physico-chemical processing or a combination of these techniques. Metal cutting has tended to dominate forming in terms of machine production. A major technological breakthrough took place in the 1950's with the advent in 1952 of the first numerically controlled machine. By the 1980's it has become synonymous with computer numerical control. With the application of these control technologies to handling and management of production there have been further applications of NC technology in the shape of flexible manufacturing systems (FMS) and computer integrated manufacture (CIM).

The industry is small in relation to the rest of the economy, in both output and employment terms, but is of major strategic significance in the contribution it makes to industrial efficiency. It achieves this by virtue of its role in both developing new production techniques to meet the needs of its customer base (primarily engineering and metal working trades) and by acting as a transmission centre for the diffusion of new techniques. In fact, despite the growth in intra-industry-trade, the existence of a strong link is still claimed between a highly competitive domestic MT industry and a successful engineering industry (Jones, 1983). A view to the contrary is that a strong engineering sector derives from the better use of standard tools rather than the use of better tools ie performance is more determined by skill levels. Given the relative ease with which technology is diffused within the global industry, the argument that the industry is of strategic importance is undermined (Carlsson, 1990).

The UK machine tool industry achieved a dominant position in the world from its inception in the late 18th century with most of the machine tool production sold to the heavy capital good industries of the Industrial Revolution. The UK maintained this position until the second half of the 19th century when directly challenged by firstly the emergence of the US industry and then the German industry . The US industry succeeded on the basis of standard machines suitable for mass production of consumer goods, a market which the UK industry chose to neglect for two reasons. First, at that time it was cheaper to employ skilled workers than to buy highly specialised machine tools. Second, consumer products that make mass manufacture on special purpose machines possible were not yet very developed in the UK (Sciberras and Payne, 1985). The German growth was achieved rather through the development of more sophisticated machine tools in which they were able to build a technological lead, partly thanks to a comprehensive system of technical education (Harrop, 1985). By the beginning of the First World War, the UK share of world production had fallen to 12% at level at which it held roughly constant until the 1960's (Jones, 1983; Committee on Industry and Trade, 1928).

More recently, the UK industry has suffered badly in the two recessions of the 1970's and 1980's. The industry shrank during in the depths of the 1979-81 recession to between one third and one half of its size in 1970. Since that trough there has been a steady recovery but employment levels remained depressed. In 1990, employment was in the region of 24,000 as compared to a level of 74,000 in 1963 (Figure 1.1). In the early 1980's the downturn coincided with the second oil price rise and the resulting global recession. In addition Government policies aimed at restraining inflation depressed demand further

at home whilst exports were severely hit by the sharp rise in sterling. The UK market suffered a continuous contraction in home demand from 1979 to 1983, falling by over 66% in real terms (Fishwick, 1985).

As a result of these trends, the UK is now the seventh largest producer of machine tools in the world. Its relative decline in world terms from its pre-eminence in the last century, can be gauged from the fact that only four UK firms are in the largest 130 in the world as defined by American Machinist.

The remainder of the paper is organised as follows. In the next section the structure of the UK machine tool industry is briefly summarised. In section 3 we describe the competitive environment British firms have to compete in. Furthermore, the impact on the organisation of the industry of such recent phenomena as disinvestment by large engineering groups and foreign direct investment will be assessed. Finally, the role of industrial policy in shaping the structure of the industry and in promoting innovation will be considered. Section 4 presents some empirical evidence of the performance of British Industry in the most recent years. Section 5 concludes the paper.

## 2. The Structure of the UK Machine Tool Industry

### 2.1 Size and Regional Distribution of Firms

The UK industry, like that of other countries, is relatively unconcentrated, being characterised by a predominance of small and medium sized firms. Tables 2.1 and 2.2 show the relative scarcity of plants employing more than 500 workers with the largest proportion of employees working in plants employing less than 100 workers (61.5% of total workforce in 1990).

There is some likelihood that the figures overstate the number of producers that can truly be said to be operating in the UK machine tool industry. In 1991, MTTA estimated that there were 120 manufacturing sites based in the UK. This compares to the 210 stated as existing in 1984 (Commission of the European Community, 1990).

Changes in the Standard Industrial Classification in 1980 makes it difficult to examine the changes in machine tool industry structure over a long period. However there does appear to be strong evidence to support an argument of a decline in importance of plants employing more than 500 workers and the increasing importance of small scale workshops. If we exclude plants with less than 20 employees, the share of workers operating in plants with more than 500 employees has fallen from 21.2 per cent in 1983 to 12.3 per cent in 1990 of the total work force. On the other hand, the share of workers operating in plants with more than 20 and less than 100 employees has increased from 28.5 per cent in 1983 to 43.4 in 1990 (table 2.3). This is more likely a reflection of both the increasing diversity of products and the growing use of sub contracting, which have served to reduce the economies of large scale production. The advantage of size derived from finance and risk spreading factors is offset by the greater flexibility of smaller companies.

The regional distribution of the industry has been largely governed by the user industries. Of total UK employment in 1990, as Table 2.4 shows, just under three quarters

was situated in the Midlands, Yorkshire and the South East of England. The heaviest concentration is in the West Midlands, associated with the rise of the automotive industry.

## 2.2 Job-Category Distribution of Employment

It is widely agreed that highly skilled labour is vital to the success of machine tool industry, as the opportunities for employing unskilled workers in this industry are limited by both the complexity of its products and the small batches in which they are produced (Prais et al, 1981).

The importance of craftsmanship is indirectly supported by the breakdown of employment by job category, as reported by the Engineering Industries Training Board. Infact, if we compare the machine tool industry structure of employment with that of all engineering it emerges that the former employees a much larger share of craftsmen (33.6% and 16.7% respectively) while the share of managerial and supervisory employees is rather similar (Figure 2.5).

From previous comparative analyses between the UK and German machine tool industries it appears that there is a high degree of similarity between the two occupational structures (Prais et al., 1981). This does not refute the wide shared opinion that one of the main reasons for the poor performance of the UK machine tool industry has to be found in the weak skill base (Jones, 1983). However it points out that what matters is not the organisational structure per se, but the true skills associated with each qualification.

## 2.3 Concentration

The definition used by the Government in compiling statistics of machine tools has varied over the time under study. The 1968 Standard Industrial Classification (MLH 332) included not only complete machines but also parts and accessories and welding machines. Since 1980 however the classification has been changed to exclude welding equipment. It is consequently difficult to construct data on trends in concentration on a consistent basis over a long period. Prais in his study of the UK machine tool industry suggests a possible small decline in concentration in the 1950's (Prais et al., 1981). After that, on the basis of the old 1968 SIC 332, there is some evidence of an increase in concentration. In 1963 sales by the five largest firms of metal cutting machine tools amounted to 27.5%. The mergers that took place in the 1960's, with the direct encouragement of the Government, resulted in an increase in CR5 to 40.6% by 1968, although this had levelled off to 39.7% in 1975. Data for metal forming machines is less complete, but indicates that in 1968 CR5 was 26.9% and by 1975 had risen to 33%.

As for the 1980's we have to resort to use of the less than satisfactory Census of Production statistics for the machine tool industry which includes engineers' small tools. Figure 2.1 shows that CR5 has fallen still further from around 15% at the beginning of the decade to 10% at present. This reflects the considerable divestment activity that has taken place since the late 70's amongst the largest companies.

However to rely purely on an aggregated figure would be misleading in this case. That there are limited barriers to entry into machine tools is indicated by the continued addition of new firms even during recessionary times. There are often small scale enterprises, often set up from remnants of a failing company, and succeeding on the basis either of novel technology or of customisation eg Winchester Machine Tools entered in the late 1980's as a phoenix company selling single spindle CNC lathes. This would ignore the considerable mobility barriers that limit such companies progress in other sectors of the machine tool industry. Jacobsson details the growth of entry barriers into the mass market CNC lathe sector due to standardisation and substantial sunk cost elements in R&D and Marketing (Jacobsson, 1986). He estimates that the main scale economies are exhausted at production volumes of 500-700 machines per annum. The larger UK firms have attempted to exploit these scale economies and tended in recent years to specialise in particular types of tool where they have a competitive advantage. Hence Jones and Shipman have 90 per cent of the market for grinding wheels. Matrix-Churchill specialises in CNC and standard lathes where it has an estimated 10-15 per cent market share. Similarly Bridgeport (35 per cent) and Cincinnati Milacron (15 per cent) in machining centres (Keynote, 1992).

Given that each producer tends to specialise in particular types of tools, concentration is greater in specific product categories, but with few exceptions the market cannot be described as highly concentrated. Figure 2.6 shows the data from the latest available survey of product concentration with the number of enterprises in each product group clearly indicating that competitive pressures are present across all markets, either from existing competitors or from producers switching across the product spectrum.

Looking instead at individual firm data, we see that UK firms do not compare in size with those of USA, Japan and Germany. Of the 136 largest machine tool companies in the world according to the American Machinist, only 4 are British. Only a handful of the larger companies are publicly quoted, the rest being either subsidiaries of large engineering groups or are owned of foreign multinationals. The remaining medium to small enterprises are independent and often family owned. The medium and larger companies have as already discussed tended to adopt a policy of supplying a specific market, but are forced by the small size of the home market to rely heavily on export trade. The smallest firms, rely more heavily on domestic sales, exploiting their proximity to the market to provide a high degree of customisation and service. More often working on ad hoc projects for particular companies or specific industries, they provide a bespoke service to the engineering sector.

To summarise, the UK machine tool industry, in common with its European competitors, is an industry of relatively low concentration with little sign of any significant increase since 1970.

## 2.4 Product Diversification

The industry has never been characterised by a high degree of diversification. Of the large enterprises, only two undertake any substantial degree of activity outside the industry. Even in these cases the diversification is closely related, being in the areas of

industrial and construction machinery. In a industry subject more than most to the cyclical behaviour of investment, this is perhaps surprising. One explanation however may lie in the typically small size of company in the sector which limits opportunities for diversification.

At the same time the extent of the involvement of the major engineering groups in machine tool production has tended to vary with the fortunes of the industry. It was severely curtailed by the recession in the early 1980's. It has also been influenced more generally by the trend within British industry to return to core activities and divest fringe operations. Even so, there was little indication that the vertical integration that existed between engineering companies and their machine tool subsidiaries was organised to provide any competitive advantage to either party. There was no indication of in house suppliers being preferred and typically the machine tool division operated entirely autonomous of its parent company (Sciberras and Payne 1985). Prominent examples of divestment have been those by Vickers and Tube Investments of KTM and Matrix-Churchill respectively. Both were the subject of management by-outs and now operate as independent machine tool manufacturers. Whilst discussing the issue of vertical integration, it should be noted that there is no indigenous producer of CNC units within the UK. Likewise none of the companies are integrated upstream into electronic component and numerical controller manufacture. There is however a strong core of software houses for the development of manufacturing systems. As a consequence of this low degree of vertical integration, the share of bought in parts is high in UK firms as compared to those in Continental Europe.

The degree of intra industry diversification ie manufacture of more than one type of machine tool has also been declining as a result of the restructuring of the industry. Companies have chosen to discontinue production of particular machine tool types, relying instead on agency agreements, often with foreign companies, to supplement their product range. B. Elliot have thus stopped producing centre lathes, concentrating instead on large milling machines and grinders. As a consequence of this move, it now sells Japanese lathes through its Elgar subsidiary. Similarly Cincinnati Milacron withdrew from high speed presses when it sold its HME subsidiary to Verson International in 1984 and has since discontinued lathe production. Any diversification has proceeded as a result of the move towards the production of advanced machine centres and cells. Again licensing has been used to effect this charge. For example, Bridgeport Machines have developed horizontal and vertical machine centres through a licence with Yasuda of Japan.

Some indication of the decline in within sector diversification can be gleaned by inspection of the Tecnologie Meccaniche data for the 100 largest European firms (excluding Italian companies). The 12 UK firms included operate in an average of 2.5 distinct product areas within the machine toll industry. This compares with the 3.2 average for the sample as a whole. Whilst not strong evidence, it does support a view that UK firms, typically being smaller, are marginally less diversified within the industry than other European firms. Even the products manufactured by the largest companies are quite restricted. The 600 Group concentrates on standard and CNC turning machines, Verson International on presses, Jones and Shipman on grinding machines and Bridgeport on volume production of milling machines.

## 3. Competition in the Machine Tool Industry

### 3.1 Pricing, Distribution Channels and the Competitive Environment

The development of the industry's pricing and product strategy has been linked closely to the demands of its traditional consumer base, ie the large aerospace and automotive companies, as well as to an emphasis on product engineering. The larger companies offered standard lower cost conventional machines whilst the majority of small to medium companies opted for a strategy of specialisation. This involved high levels of product customisation and the development of one-off special purpose machines. A full range of machine tools could only be offered by the large groups, with those unable to provide such a range often acting as agents for competitors.

This reliance on applications engineering and customisation in the UK industry generally implied that price was a secondary issue in the competitive environment faced by manufacturers in the 1970's. The largest customers in aerospace and automobile industries were more concerned with quality and efficiency than with price. However falling demand levels and an increasingly fragmented consumer base meant that the market has become more price conscious.

The distribution systems operating in the industry have developed out of this commitment to service. Machine tools manufactured in the UK tend to be sold direct by the company to the ultimate user, although in areas such as volume production of standard machines some producers have opted to sell through agents and wholesale companies, as well as through directly owned sales subsidiaries. Imports have historically found an easy route to the UK market either through a company's UK based manufacturing subsidiary or through a well developed system of UK agents. Indeed it has been a feature of the industry, more recently that UK manufacturers have acted as agents for foreign machine tool manufacturers in order to be able to maintain a full product line. The Strathclyde International Business Unit estimated that in 1991, of the 45 European machine tool manufacturers surveyed, 22 owned a sales subsidiary in the UK. The use of such subsidiaries will become increasingly important with the move towards FMS where attention to all aspects of service, both pre and post sales, is seen a crucial.

Indigenous firms have been more reluctant to follow this strategy and set up such sales and service centres abroad. The foreign owned companies typically have the network of the parent to rely on, but these are predominantly US based. Yamazaki seems to be the exception with technical centres throughout Europe. As for the large UK owned firms, there is a notable tendency to favour US and Empire locations, with only B. Elliot owing sales outlets in more than 2 European countries. The inevitable consequence of this is an undue reliance on agencies as a means of distribution. As already discussed this may constrain future sales in FMS where proximity to customers is of paramount importance.

Returning to the position in the early 1980's, the industry was classified by the BCG report as being committed to two distinct market environments (Commission of the European Community, 1990). Stalemate strategies typified those companies offering the conventional general purpose machines where the established technology was mature and opportunities for differentiation were limited. The remainder of the

industry opted for an environment associated with specialisation as found in the manufacture of special purpose machines where product customisation is high and the technology is dynamic.

With the shrinking of its traditional consumer base at home, the industry found itself in a poor competitive position. The UK firms had few competitive advantages in NC machine tools; this was an area where the Japanese industry was particularly successful in developing products aimed at a mass market in engineering rather than at the sophisticated demand of particular sectors. At the same time, the volume segment of the market was being threatened by the substitution of NC for conventional machine tools as well as by increasing levels of competition from developing countries in established Commonwealth markets. So the UK manufacturers who tried to alter their strategies, whether to different markets like the US, or to different customers, like the jobbing and oil industries, found themselves facing insurmountable opposition from Japanese producers.

The product strategies followed by UK companies in the 1980's have been to withdraw from those declining markets such as standard lathes subject to low cost competition from the Far East and switch to products offering grater prospects for growth. These have been those segments where the machine is sold either on the base of technological advantage or for its capability to meet highly specific needs on the part of the customer. Hence companies have been reorientating their range to distance themselves from the stalemate market environment, and place an increasing emphasis on volume production in areas of rapid technical change. At the same time, this led to firms to acknowledge that marketing had to play a larger part in product development with greater emphasis over product engineering. More firms are subsequently shying away from the role of manufacturer and emphasising their role in R&D, assembly and marketing (Rendeiro, 1988).

The industry has witnessed a move out of conventional machine tools, in particular conventional lathes, and the switch to NC machine tools. Figure 3.1 shows the extent of companies' success in trebling the proportion of NC machine tools of total sales from 14.5% in 1980 to 52% in 1990. That UK manufacturers were slow in recognising market developments is indicated by the fact that in 1981 NC accounted for just under 40 per cent of domestic machine tool consumption, but sales by UK manufacturers comprised less than half that percentage. The gap has been entirely narrowed since the mid 1980's and now the proportion of consumption and manufacturers sales is roughly equal. Indeed the relative success was such that the UK achieved the greatest rise in the share of machining centres in production of all European producers in the 1980's. As Figure 3.1 indicates, machine centres account for 20.8 per cent of total machine tool sales by British manufacturers in 1990 as compared to 4.1 per cent in 1980.

A volume strategy has required a considerable degree of standardisation and rationalisation of product design, in order to be able to exploit available economies of scale in production. So, Cincinnati Milacron, the UK subsidiary of the US giant have phased out a large number of low volume products, in order to concentrate on the production of a narrow range of low cost horizontal and vertical machining centres for world markets.

Simultaneously other producers have followed the route of supplying niche

markets through both increased customisation of product and greater emphasis in developing supplier-customer relationships. As is apparent in Figure 3.1, metal forming, in which "off the shelf' solutions are less feasible, have also retained their share of UK manufacturers sales. Elements of customisation have become equally important in metal cutting tools. Butler and Newall, part of the 600 Group, have concentrated on the small volume production of large milling machines with a strategy based firmly on applications engineering. This approach has fared less well in standard and CNC lathes where attempts to provide high performance large machines have been de-emphasised in the face of limited markets. Instead there has been a switching into the production of medium performance smaller CNC lathes. Successful firms have become aware of the need to be both technically advanced and aware of the requirements of the market (Jacobsson, 1986). Consequently there has been a move towards FMS and greater emphasis has been placed on the provision of solutions by machine tool companies. This has required the selling of systems rather than machines and the inevitable need to sell other companies hardware.

A further feature of the strategy of UK manufacturers in the 1980's has been a shift in export emphasis away from traditional "Empire" markets and towards the EC. In 1991 the EC accounted for just over half of all exports compared to 28% in 1980. Germany has now become the largest single destination for sales. Despite this obvious move orientation towards the east, the UK still however retains a higher share of export sales outside in EC and North America than any other European producer.

### 3.2 Research, Product Innovation and Industrial Policy

Evidence from a study of the UK industry in the mid 1980's revealed that most firms did not maintain a formal R&D facility, this being restricted to a small number of the larger firms (Sciberras & Payne 1985). The general level of formal R&D is low and the regular surveys by the Business Statistics office, shown in Figure 3.2, reveal that R&D to sales ratios have stuck in the 1-3% range since 1972. This was marginally above the ratio for mechanical engineering in general, But compares unfavourably with the 3-4% common amongst European producers (Commission of European Comunity, 1990)

There is a caveat to these statistics, however. Technical effort in the industry often exists outside the confines of a separate R&D facility. This could include product development and applications engineering. The most significant technical efforts are found in those companies producing special purpose and customised machines. These firms devoted considerable resources to product development, aimed at meeting the needs of specific customers. The Atkins study found a large variance in resources devoted to R&D amongst UK Machine tool manufactures, ranging from as low as 2 per cent to as high as 15 per cent as a proportion of sales.

There is little evidence that those companies which are subsidiaries of larger groups are supported by their parents' formal R&D function, as is the case in Japan; the policy seems to be that their research effort is deemed to be their independent responsibility.

Neither is the degree of co-operative research high. Some research work is

conducted through the research association, MTIRA, but this is concerned largely with basic technology and safety requirements. Its contribution is not substantial. In 1978, the latest year for which figures are available, 19% of research spending was undertaken within research associations. The remainder was undertaken within private firms. At the same time, there is little evidence to support a belief in strong and close co-operation between the machine tool builders and the Universities.

As already has been noted, British firms were slow to develop general purpose CNC machine tools, instead continuing to produce conventional machine tools. One point to emerge from a comparative study of the UK and Swiss industries was that UK companies have generally been slow in product innovation, whilst displaying equal speed in the area of process innovation, One reason may be the relative independent financial position of the Swiss companies, whilst UK firms, at least those which are subsidiaries of larger groups, have been limited by group financial requirements (Ackermann and Harrop, 1985). However this merely highlights the differences in relative performance between two countries rather than an overall approach to product development. Indeed a criticism made of UK producers in the past has been the undue emphasis placed on customisation and product innovation for its own sake rather than for the requirements of the market place.

Most of the product development which has taken place in recent years has been incremental in nature rather than revolutionary, typically involving raising machine efficiency as well as the integration of electronics into machine tools. The strategy has been broadly the same however with its stress on product innovation rather than manufacturing engineering.

Government's role in the promotion of the industry has tended to vary over time and with the coming of a avowed non interventionist Government in 1979, the industry has seen that role diminish. State assistance for the industry has taken a variety of forms over the period under consideration. The simplest, Government funding of research has occasionally supplemented the total although this is not on a regular basis, instead being devoted to special initiatives. In 1978, 82% of R&D spending was privately financed. In 1989, this had fallen to 57%, but this was of out of a figure of only £8.8 million.

The Government has attempted in other ways to promote innovation by machine tool firms. Under the Science and Technology Act of 1965, a Pre-Production Order Scheme (PPOS) allowed the Government to buy pre-production models of advanced machine tools and grant free use to companies on a trial basis. A year later, a second scheme required users to pay to become involved, but this was withdrawn in 1970. Although the scheme encouraged the development of 49 new models, only 5 had been sold to users by 1968 (Sciberras & Payne 1985).

In 1975, the Machine Tool Industry Support Scheme granted loans for the design, development and marketing of new machine tools. The scheme was closed in 1977 and by 1980 some £17.4m had been paid out. In 1977 a scheme was introduced allowing grants for product and process development and this scheme, along with an extended PPRO, was incorporated into the Support for Innovation scheme in 1983. This itself finished in 1987 since when there have been no further grant schemes.

In addition to these schemes for the promotion of innovation within the industry, there have been a number of initiatives with the objective of stimulating demand for

machine tools. Only the Additional and Accelerated Order Scheme of 1982 was directly aimed at the industry. Indirect schemes have been the Flexible Manufacturing System Scheme 1972 and the Small Engineering Firms Investment Scheme (1982). These schemes were discontinued in the late 80's, and although some £100 million was designated for use, data on actual expenditure is not yet available.

At a more general level the State has directed an industrial policy towards the sector through the encouragement of mergers and foreign direct investment. We leave detailed discussion of these to later in the paper. However, the notion that Government should seek to encourage amalgamation of machine tool companies, as it did in the 1960's, would be considered an anathema by the present Conservation administration. More in accordance with its philosophy has been the direct encouragement it has given to foreign companies setting up in the UK. In the one specific case where this strategy has proven successful in the machine tool industry, a grant attracted Yamazaki to its Worcester location.

### 3.3 External Growth

In examining acquisition activity in the UK machine tool industry, one should bear in mind that the industry was relatively quick in pursuing merger of indigenous companies as a means of building competitive advantage. After numerous Government reports in the post war period, the Government sponsored Industrial Reorganisation Corporation (IRC) considered that product rationalisation was necessary and that this aim would be best achieved by an industry comprised of fewer and larger firms. Up to 1970 the IRC encouraged take-overs of several large UK manufacturers by Alfred Herbert, so that by the late 1960's it was claimed to be the largest machine tool company in the world. This encouragement was stepped up in 1970 with the IRC taking a direct interest in the joint venture that Alfred Herbert had set up in 1967 with Ingersoll of the US. This venture proved to be a failure and Alfred Herbert was taken into public ownership in 1975, before eventually being broken up and sold off on a much reduced scale to the private sector in 1980. The IRC was also instrumental in bringing about the merger of Kearney and Trecker-Marwin in 1973. Prais et al criticise the strategy for its unquestioning pursuit of firm rather than plant size particularly when any rationale relating to economies of scale relates more to the latter rather than the former (Prais et al., 1981).

Perhaps as direct result of the failure of the merger strategy, the incidence of merger activity has been small since the mid 1970's and since the mid 1980's has gone into reverse with an increase in divestment by the large engineering groups. The 600 Group has disposed of its Sykes and Edwards subsidiaries, Vickers has divested KTM and both Tube Investments and Megitt have sold off their machine tool divisions to their management.

The few acquisitions that have been effected have been as a direct result of liquidation or withdrawal from the sector. FMT (once KTM) has acquired Keams Richards and the Gateshead plant of Noble Lund as a result of divestment, whilst Jones and Shipman have acquired the remaining interest in its joint venture with Brown and Sharpe following the US company's decision to leave the UK. These acquisitions have

chiefly been for the purpose of gaining strategic assets, rather than the slavish pursuit of size. The rationalisation of the industry that has taken place in the late 80's has focused more on the cutting of overheads in R&D and marketing as well as improving the product portfolio of the companies concerned. So, in the Jones and Shipman case, the company has acquired the technology for the production of CNC creep feed grinders thus enabling its expansion into the area of production grinding (and away from tool shop grinding).

There are exceptions to this however. Verson International has brought together a number of smaller firms in the pressing machine sector, and recently BSA Tools and Matrix-Churchill merged to form a volume producer of CNC lathes. Merger and acquisition activity has however been limited to the larger builders. The small companies remain independent, often being family controlled and therefore less susceptible to take-over. It is a notable feature of the industry, in contrast to other European industries that the degree to which minority holdings in the smaller companies are held by the larger groups is very small. No groupings of companies exist comparable to that in the Italian machine tool industry.

### 3.4 Foreign Direct Investment

There has always been a strong involvement in the UK by US machine tool manufacturers who initially exploited their company specific assets through licensing and exports. Eventual dissatisfaction with licensing as a suboptimal means of exploiting company assets led to foreign direct investment (Young, 1990). Indeed at the beginning of the 1980's foreign penetration of the machine tool industry was higher than that for manufacturing in general. Currently, of the 20 foreign subsidiaries listed by ICC in 1990, 14 have North American parents, while only two have EC holding companies. As already mentioned however there has been a growth in the setting up of sales subsidiaries in the UK by the major European producers thereby avoiding the need for direct investment in manufacturing facilities. Since the beginning of the 1980's there has been a noticeable decline in foreign owned businesses, as US firms have withdrawn to their home market. Some examples of this are the Brown and Sharpe sale in 1991 and the Verson International management buy-out from its US parent in 1985. The US companies have been particularly severe in cutting back capacity, Warner and Swasey closed its UK factory in 1982, Ex-Cell-O shutdown its UK operation in grinding machines and De Vleig Machine Tool went into liquidation in 1991.

As Figure 3.3 shows, as a result of divestment and closures, the foreign owned share of employment has halved over a seven year period. This trend has been halted, one would suspect, by the growth in Japanese foreign direct investment in the UK. The first such move was the new investment that Yamazaki made in 1987 in a factory in Worcester for the production of CNC lathes and machining centres. Supported by a £5.2 million Government grant, the facility was planned to reach a full capacity of 1200 CNC lathes and machining centres. It stands alone from the rest of the UK industry in terms of its stress on volume production. Sales per employee in 1990 stood at £170,000, almost three time that of other UK volume manufacturers like Cincinnati Milacron, Bridgeport and Colchester Lathe. Yamazaki used the plant as a entry to Europe thereby circumventing any voluntary restrictive agreements as well solving difficulties posed

by a strong Japanese currency. It estimated that local sourcing would amount to 60 per cent and that 80 per cent of output would go overseas (O'Brien, 1987).

Not only does FDI feature heavily within the industry, but in the 1980's, licensing agreements have become increasingly common. Typically the first to move in this direction have been the subsidiaries of US firms which have concluded a number of licensing agreements with the Japanese. As already mentioned, Bridgeport have licensed Yasuda technology whilst Jones and Shipman have been able to enter the production of EDM through liaison with Sodick. In the area of machining centres, FTM have a licence-build agreement with Mitsubishi for vertical machining centres and Matrix-Churchill with Takisawa, both of Japan.

No discernible feature characterises all foreign investment within the UK machine tool industry with each differentiated by the strategic aims of the company undertaking it. The Japanese investment has fitted in with their pursuit of a volume strategy. Some of the US companies similarly are switching in this direction (Young et al., 1991). This contrasts with the differentiated strategy of some of the European producers who seek to move downstream in the value chain by assuming greater control over marketing and distribution channels. Several German companies importing into the UK have sought to emphasise the range of their products as well as the importance of the entire chain (Young 1990). The few UK firms which are of sufficient size to adopt on overseas investment strategy have tended to opt for the purchase of sales subsidiaries, more often in historic "Empire" markets. Some recent joint ventures in the Eastern Bloc, have been undertaken for reasons of market access as well as to source low cost machinery.

## 4. Performance

### 4.1 Sales and Foreign trade

Figure 4.1 shows that despite the strong recovery that the industry has experienced in the 1980's, once account is taken of inflation the level of both UK manufacturers' sales and UK consumption in 1990 is still below that of 1970. The figure on sales may indicate the level of activity within the industry better than the production figure presented in figure 1.1, because of the growing product sophistication which is reflected in higher prices.

The one encouraging feature has been the steep rise in NC machine tools consumption through the revival in investment by UK manufacturers in new equipment. The latest survey of the machine tool population taken in 1988 shows the large rise in the number of NC machine tools in use in the UK since 1982. It indicates that the UK now has a comparable percentage (7.3%) of NC in its total machine tool population as compared with the other industrial nations although its installed base is smaller. UK machine tool producers have benefited widely from this trend. In 1980 NC machine tool sales were 17 per cent of total sales by UK manufacturers. In 1991 the NC share has increased up to 60%.

Figure 4.2 shows that following the general positive trend in horizontal trade both export propensity and import penetration have increased in the last twenty years.

However, as a result of the downturns in the economic cycle in the mid 1970's and early 1980's import penetration has grown more rapidly than export intensity. The result was the balance of trade in machine tools has been in the red since 1984. The poor export performance relative to the rest of the world can also be seen in figure 4.3 which shows that since 1971 UK exports and production have grown at roughly the same annual rate of under 7 per cent in nominal terms. However world trade in machine tools has expanded at a compound rate of 10.5% showing that UK producers have failed to capture their share of growing markets. The result has been a halving in their share of world export trade.

As far as UK major trading partners are concerned the share of UK export towards the European Community Countries has dramatically increased in the last ten years, even when allowance is made for the increased size of the Community. In fact, if we compare the 1990 figures with the 1980 ones it emerges that the share of EEC export on total export has increased from 25.9 per cent to 48.3 per cent. On the contrary, the importance of the previously captive Commonwealth markets have progressively decreased. As expected, on the import side, the share of Japan and other new industrialised countries have increased (see figure 4.4)

The European Commission report of 1983 attributes the UK poor trade performance to the tendency of UK manufacturers to specialise in the export of standard low cost machine tools. This strategy was considered to be risky (Jones, 1983) for a country with high labour costs, since new competitors, such as South Korea and Taiwan entered the industry. Consequently, UK products have been increasingly subject to both market competition from the industries of the developing countries and product competition from numerically controlled machines.

One, albeit crude, measure of the level of "sophistication" of UK exports is given by the value to weight ratio. Figure 4.5 shows the ratios for both imports and exports since 1971 and suggests support for the hypothesis that the UK has continued to import machine tools of higher value per ton than those it has exported. Although this trend is undoubtedly distorted by movements in the exchange rate they are consistent with the pattern of trade in one particular product area, computer numerically controlled machine tools. The proportion of NC machines in total imports has risen from 22.1% in 1975 to 41% in 1982 and 45% in 1989. The same proportion in UK exports was only 6% in 1975, 16% in 1982 but had recovered strongly to 37% in 1989. There is some support from the shift-share analysis of trade patterns that UK firms have been relatively more successful in the late 1980's in recapturing export markets (Vitali, 1990).

### 4.2 Profits and Company Performance

UK productivity levels have consistently been below those of the US and West Germany (Prais 1981) and the recent report by Atkins Consultancy shows the UK industry to have the lowest value added per worker of all the major industrialized countries (Commission of European Community, 1990). Prais attributed the cause of this shortfall primarily to skill shortages and the "general technological backwardness" of the training in the UK (Prais et al., 1981).

The recovery in the industry since the depths of the recession is reflected in increasing profitability although returns are far from sufficient to attract finance from other sectors. The ICC Business Ratios analysis in figure 4.3 shows return on capital never to have exceeded 15% since the early 1970's. Figure 4.4 offers a breakdown of profits by ownership and size for the 1980's. The average profit margin earned by independent companies has typically exceeded that for subsidiaries of large groups. Furthermore there seems little evidence of any positive link between size and profitability. Average profit margins for the largest companies have consistently been below those of the industry as a whole and it is this poor performance which has resulted in the number of divestment by the larger groupings in the late 1980's.

There has been a substantial fall in profitability in 1991, with the consequence that a number of major producers have announced further closure plans. 600 Group, Bridgeport and BSA Churchill have all announce the closure of at least one of their sites. Similarly, at the time of writing, B. Elliot was rumoured to be in the process of withdrawing from machine tool production entirely. Only Yamazaki of the major producers remains profitable, since the structure of its costs allows for profits at only 50 per cent of capacity (Keynote, 1992).

## 5. Conclusions

The fortunes of the UK machine tool industry have, in many respects, mirrored those of the rest of British industry since the Second World War. It has seen its position of eminence in world markets diminish as its protected Commonwealth market base came under threat from first European, then Far Eastern competition. Eventually, the domestic market has begun to suffer from rising levels of import penetration as the Japanese, in particular made inroads on the strength of new technologies.

This relative decline has been both a part and a result of the weakening domestic manufacturing base (Stoneman, Bosworth and Gibbons, 1992). Without a strong indigenous engineering industry able to capture world sales, the industry has been unable to exploit the economies in production and research, that the Japanese industry found to so advantageous in its development (Carlsson, 1990). Indeed the requirements of the dominant domestic customers, the automotive and aerospace industries, had resulted in domestic manufactures producing machine tools which although technologically advanced had limited opportunities for the development of volume sales and the resulting decline in unit costs. As a result, the industry has been unable to exploit the opportunity that existed in the development of the new CNC technology for mass market. Consequently it lost a substantial share of its domestic market to the Japanese who has pursued such a strategy with a large degree of success in world markets.

The contribution of Government to the poor performance of the industry should not be overlooked. This has assumed many forms. Most apparent has been the encouragement the State gave to the disastrous mergers aimed at restructuring the industry in the 1960's. However there has also been the indirect influence felt by the industry of stop-go macroeconomic policies whose cycles have been and continue to be so damaging to the industry.

The industry has been partially successful in shifting its strategy since the late

80's, placing a greater emphasis on the development of new technologies which either offer the prospect of standardisation, and therefore high volume, or command a premium in the market place because of their customised nature. So a switch to the selling of systems rather than standalone units has characterised the industry more recently, even if this has involved selling imported machines as part of that system. Consequently software rather than hardware has become an increasingly important part of the search for competitive advantage.

## REFERENCES

Ackerman and Harrop (1985), Management of Technological Innovation in the Machine Tool Industry, 15(3).

Carlsson B. (1990), Small-scale Industry at the Crossroads. US Machine Tools in Global Perspective, in Z.J. Acs and D.B. Audretsch (eds) The Economics of Small Firms, Kluwer, Dordrecht.

Commission of the European Communities (1983), The European Machine Tool Industry - Situation and Prospects, Brussels.

Commission of the European Communities (1990), Strategic Study on the EC Machine Tool Sector, Brussels.

Fishwick F. (1985), Government Aid to Industry. A case Study in Machine Tools, Cranfield Press, Cranfield.

Harrop J. (1985), Crisis in the Machine Tool Industry: A Policy Dilemma for the European Industry, Journal of Common Market Studies 24(1), 61-75.

Keynote (1990 and 1992), Machine Tools 8th and 9th Edition, Keynote Publications, London.

Jacobsson S. (1986), Electronics and Industrial Policy. The case of Computer Controlled Lathes, Allen and Unwin, London.

Jones D.T. (1983), Machine Tools: Technical Change and a Japanese Challenge, in G. Shepherd et al (eds) European Industries. Public and Private Strategies for Change, Frances Pinter, London.

MTTA (various years), Machine Tool Statistics. MTTA London.

O'Brien P. (1987), Machine Tools - Growing Internationalisation in a Small Firm Industry, Multinational Business, Winter.

Prais et al. (1981), Productivity and Industrial Structure, Cambridge University Press, Cambridge.

Rendeiro J.O. (1985), How Japan Came to Dominate the Machine Tool Industry. Long Range Planning, June 18(3), 62-67.

Sciberras E. and B.D. Payne (1985), The Machine Tool Industry. Longman. Harlow.

Stoneman P., D Bosworth and A. Gibbons (1992), Investment, Productivity and Competitiveness in UK Manufacturing Industry, Research Report, Institute for Employment Research, Coventry.

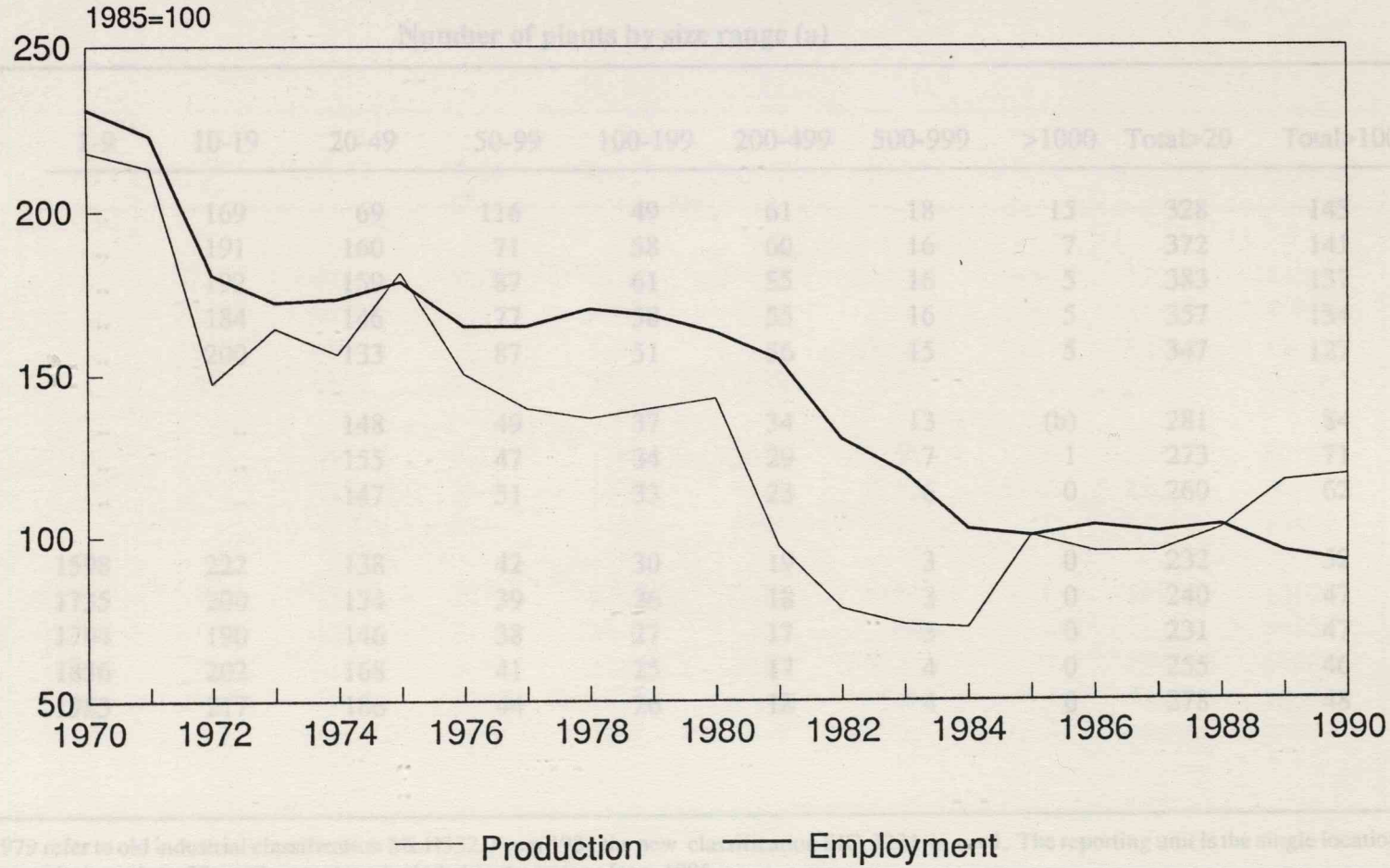
Vitali G. (1990), Determinant of International Trade of Machine Tools During the 1980's: A Shift-Share Analysis. Technovation, Dec 10(8) 507-509.

Young S. (1990), Japanese Move the Machine Tool Industry up a Gear. Multinational Business, Autumn.

Young S. , S. Dunlop and N. Hood (1992), The Strategic Response of Multinationals in the Machine Tool Industry, in P. Barrod and C. Cooper (eds) Managing Organisations in 1992, Routledge, London.

Figure 1.1

# Production and Employment Indices UK Machine Tool Industry 1970-90




Source: DTI, DOE

Figure 1.1 Production and Employment Indices
UK Machine Tool Industry 1970-90

**Figure 2.1**

**The Structure of the UK Machine Tool Industry 1971-1990**

**Number of plants by size range (a)**

| | 1-9 | 10-19 | 20-49 | 50-99 | 100-199 | 200-499 | 500-999 | >1000 | Total>20 | Total>100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | .. | 169 | 69 | 116 | 49 | 61 | 18 | 15 | 328 | 143 |
| 1975 | .. | 191 | 160 | 71 | 58 | 60 | 16 | 7 | 372 | 141 |
| 1976 | .. | 192 | 159 | 87 | 61 | 55 | 16 | 5 | 383 | 137 |
| 1977 | .. | 184 | 146 | 77 | 58 | 55 | 16 | 5 | 357 | 134 |
| 1978 | .. | 200 | 133 | 87 | 51 | 56 | 15 | 5 | 347 | 127 |
| 1982 | .. | .. | 148 | 49 | 37 | 34 | 13 | (b) | 281 | 84 |
| 1983 | .. | .. | 155 | 47 | 34 | 29 | 7 | 1 | 273 | 71 |
| 1984 | .. | .. | 147 | 51 | 33 | 23 | 6 | 0 | 260 | 62 |
| 1985 | 1598 | 222 | 138 | 42 | 30 | 19 | 3 | 0 | 232 | 52 |
| 1987 | 1735 | 200 | 154 | 39 | 26 | 18 | 3 | 0 | 240 | 47 |
| 1988 | 1794 | 190 | 146 | 38 | 27 | 17 | 3 | 0 | 231 | 47 |
| 1989 | 1856 | 202 | 168 | 41 | 25 | 17 | 4 | 0 | 255 | 46 |
| 1990 | 1983 | 217 | 186 | 44 | 26 | 18 | 4 | 0 | 278 | 48 |

(a) Data up to 1979 refer to old industrial classification MLH332. From 1981 the new classification SIC 3221 is used. The reporting unit is the single location plant. Plants with less than 20 employees were included in the survey from 1985.

(b) Data withheld

Source: Census of Production.

Figure 17

The Structure of the UK Machine Tool Industry, 1971-1990

Number of plants by size range (a)

**Figure 2.2**

## The Structure of the UK Machine Tool Industry 1971-1990

### Employment by size range (a)

| | 1-9 | 10-19 | 20-49 | 50-99 | 100-199 | 200-499 | 500-999 | >1000 | Total>20 | Total>100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1975 | .. | 2725 | 4832 | 5074 | 8373 | 19148 | 10646 | 9591 | 57664 | 41758 |
| 1976 | .. | 2742 | 4875 | 6017 | 8753 | 17677 | 11244 | 7581 | 56147 | 45255 |
| 1977 | .. | 2593 | 4514 | 5437 | 8094 | 17632 | 10864 | 7051 | 53592 | 43641 |
| 1978 | .. | 2853 | 4006 | 6102 | 7332 | 17652 | 9672 | 6848 | 51612 | 41504 |
| 1982 | .. | .. | 4604 | 3527 | 5364 | 10634 | 10189 | (b) | 34318 | 26187 |
| 1983 | .. | .. | 4811 | 3160 | 4809 | 9316 | 4725 | 1212 | 28033 | 20062 |
| 1984 | .. | .. | 4540 | 3567 | 4655 | 6895 | 3939 | 0 | 23596 | 15489 |
| 1985 | 5056 | 2993 | 4310 | 2678 | 4226 | 6063 | 1902 | 0 | 19179 | 12191 |
| 1987 | 4757 | 2773 | 4598 | 2719 | 3517 | 5156 | 1963 | 0 | 17953 | 10636 |
| 1988 | 5058 | 2691 | 4366 | 2652 | 3744 | 5217 | 1927 | 0 | 17906 | 10888 |
| 1989 | 5230 | 2907 | 4977 | 2870 | 3438 | 4781 | 2584 | 0 | 18650 | 10803 |
| 1990 | 5930 | 3182 | 5466 | 2957 | 3468 | 5129 | 2380 | 0 | 19400 | 10977 |

(a) Data up to 1979 refer to old industrial classification MLH332. From 1981 the new classification SIC 3221 is used. The reporting unit is the single location plant. Plants with less than 20 employees were included in the survey from 1985.
(b) Data withheld

Source: Census of Production.

## Figure 2.3

### The Structure of the UK Machine Tool Industry 1975-1990

**Share of employment in plants with more than 20 employee (a)**

| | 20-49 | 50-99 | 100-199 | 200-499 | 500-999 | >1000 |
|---|---|---|---|---|---|---|
| 1975 | 8.4 | 8.8 | 14.5 | 33.2 | 18.5 | 16.6 |
| 1976 | 8.7 | 10.7 | 15.6 | 31.5 | 20.0 | 13.5 |
| 1977 | 8.4 | 10.1 | 15.1 | 32.9 | 20.3 | 13.2 |
| 1978 | 7.8 | 11.8 | 14.2 | 34.2 | 18.7 | 13.3 |
| 1982 | 13.4 | 10.3 | 15.6 | 31.0 | 29.7 | (b) |
| 1983 | 17.2 | 11.3 | 17.2 | 33.2 | 16.9 | 4.3 |
| 1984 | 19.2 | 15.1 | 19.7 | 29.2 | 16.7 | 0 |
| 1985 | 22.5 | 14.0 | 22.0 | 31.6 | 9.9 | 0 |
| 1987 | 25.6 | 15.1 | 19.6 | 28.7 | 10.9 | 0 |
| 1988 | 24.4 | 14.8 | 20.9 | 29.1 | 10.8 | 0 |
| 1989 | 26.7 | 15.4 | 18.4 | 25.6 | 13.9 | 0 |
| 1990 | 28.2 | 15.2 | 17.9 | 26.4 | 12.3 | 0 |

(a) Data up to 1979 refer to old industrial classification MLH332. From 1981 the new classification SIC 3221 is used. The reporting unit is the single location plant. Plants with less than 20 employees were included in the survey from 1985.

(b) Data witheld

Source: Census of Production.

## Figure 2.4

### Regional Distribution of Employment at April 1990

| | Employment count. from EITB returns | |
|---|---|---|
| | Numbers | % total |
| Standards regions of England | | |
| West Midlands | 5349 | 23.8 |
| Yorkshire & Humberside | 4216 | 18.7 |
| South East | 4025 | 17.9 |
| East Midlands | 2821 | 12.5 |
| South West | 1579 | 7.0 |
| East Anglia | 1018 | 4.5 |
| North West | 896 | 4.0 |
| Northern | 626 | 2.8 |
| **England (sub total)** | **20530** | **91.2** |
| Scotland | 1520 | 6.8 |
| Wales | 453 | 2.0 |
| **Total** | **22503** | **100.0** |

The above results are for Activity Heading 3221 of the 1980' Standard Industrial Classification

Source: E.I.T.B. statutory returns.

**Figure 2.5**

**Employment by job-category (1990)**

| | Machine Tools (22503 empl.) | All Engineering (1867341 empl.) |
|---|---|---|
| Craftsmen | 33.6 | 16.7 |
| Operators and others | 25.4 | 41.6 |
| Managerial, technical administrative , & clerical | 36.8 | 37.1 |
| Supervisors | 4.2 | 4.6 |
| Total | 100.0 | 100.0 |

The above results are for Activity Heading 3221 of the 1980' Standard Industrial Classification

Source: E.I.T.B. statutory returns.

**Figure 2.6**

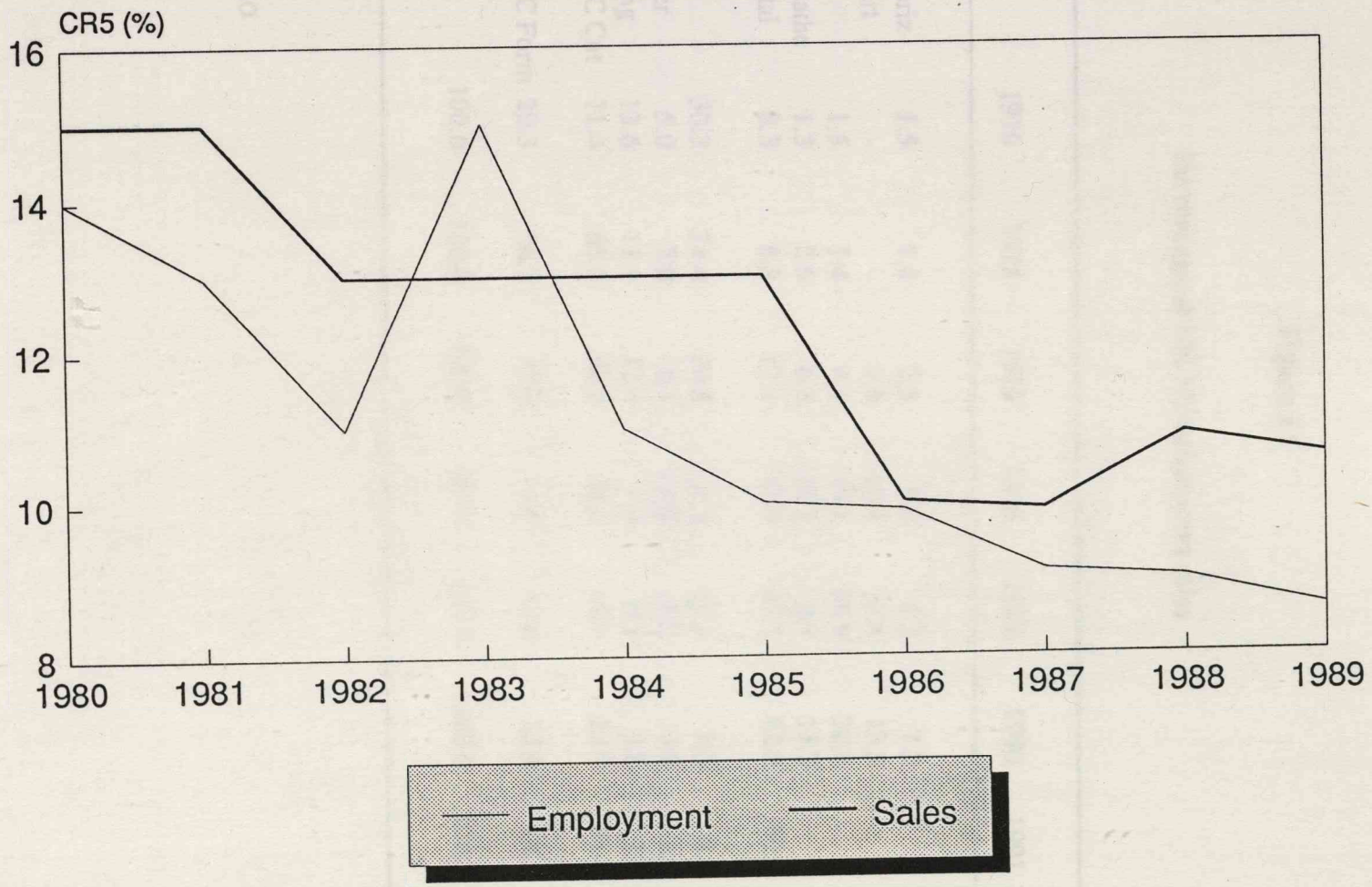
**Table Concentration Ratios for Selected Products (CR5)**

| | 1975 % | 1976 % | 1977 % | No of enterprises in 1977 |
|---|---|---|---|---|
| NC MT complete | 69.1 | 71.8 | 70.1 | 19 |
| Non NC MT complete | | | | |
| Boring and drilling | 68.8 | 71.3 | 69.3 | 35 |
| Grinding and honing | 57.7 | 62.6 | 61.2 | 58 |
| Milling | 83.1 | 87.1 | 90.1 | 24 |
| Turning | 65.7 | 67.2 | 67.6 | 37 |
| Unit construction and transfer | 58.8 | 65.5 | 64.7 | 32 |
| Other non numerical controlled cutting tools | 59.2 | 55.4 | 51.6 | 40 |
| Parts and accessories | 29.7 | 29.8 | 30.5 | 118 |
| Non NC metal forming complete | | | | |
| Bending and forming | 61.1 | 51.6 | 51.2 | 49 |
| Presses | 61.6 | 58.9 | 50.9 | 37 |
| Shearing | 78.4 | 78.8 | 75.0 | 25 |
| Other | 64.4 | 58.3 | 57.6 | 34 |
| Parts and accessories | 55.0 | 47.0 | 43.4 | 56 |
| Physico-chemical process tools and parts | 87.4 | 77.5 | 87.6 | 18 |

Source:

Figure 2.7

## Concentration Ratio CR5
## UK Machine Tools (inc small tools)




Source: Census of Production PA322

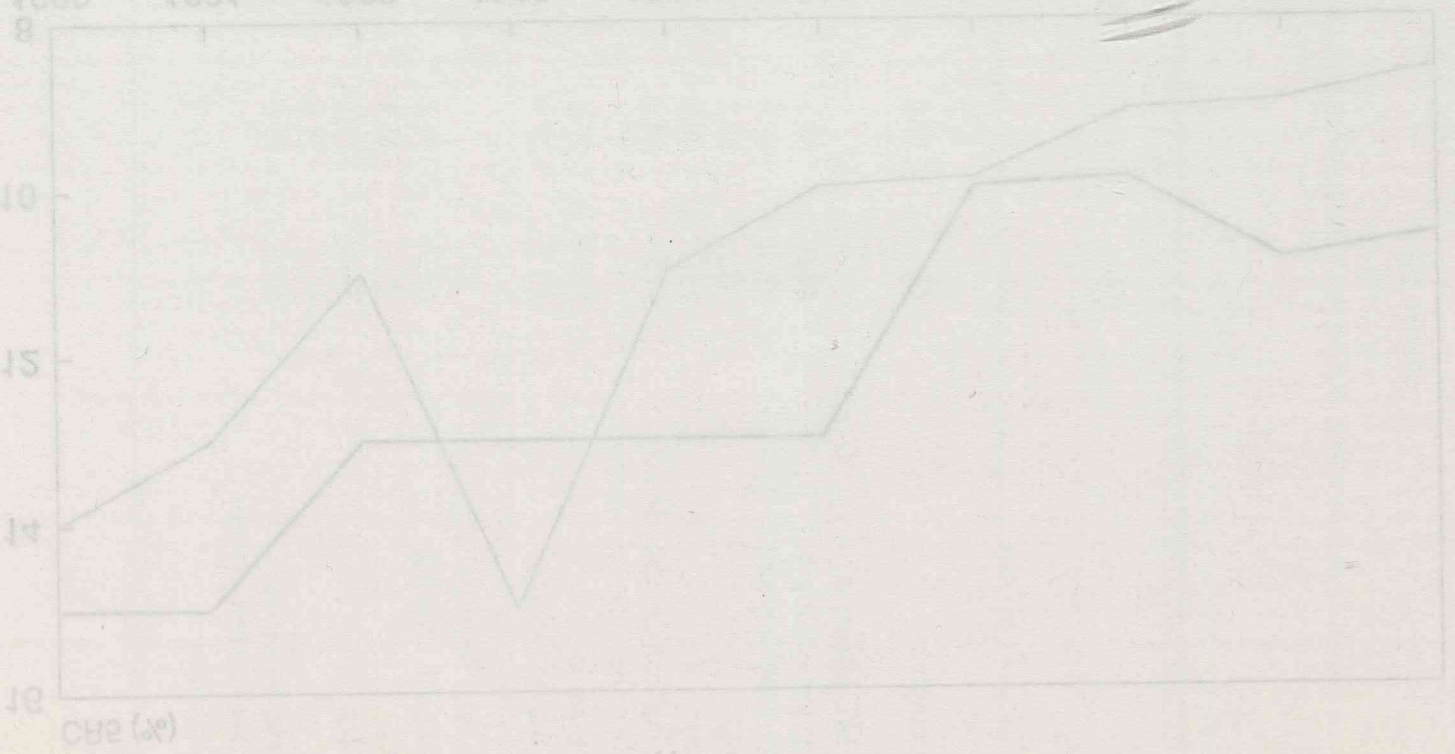

8
10
12
14
16
CR2 (%)

**Figure 3.1**

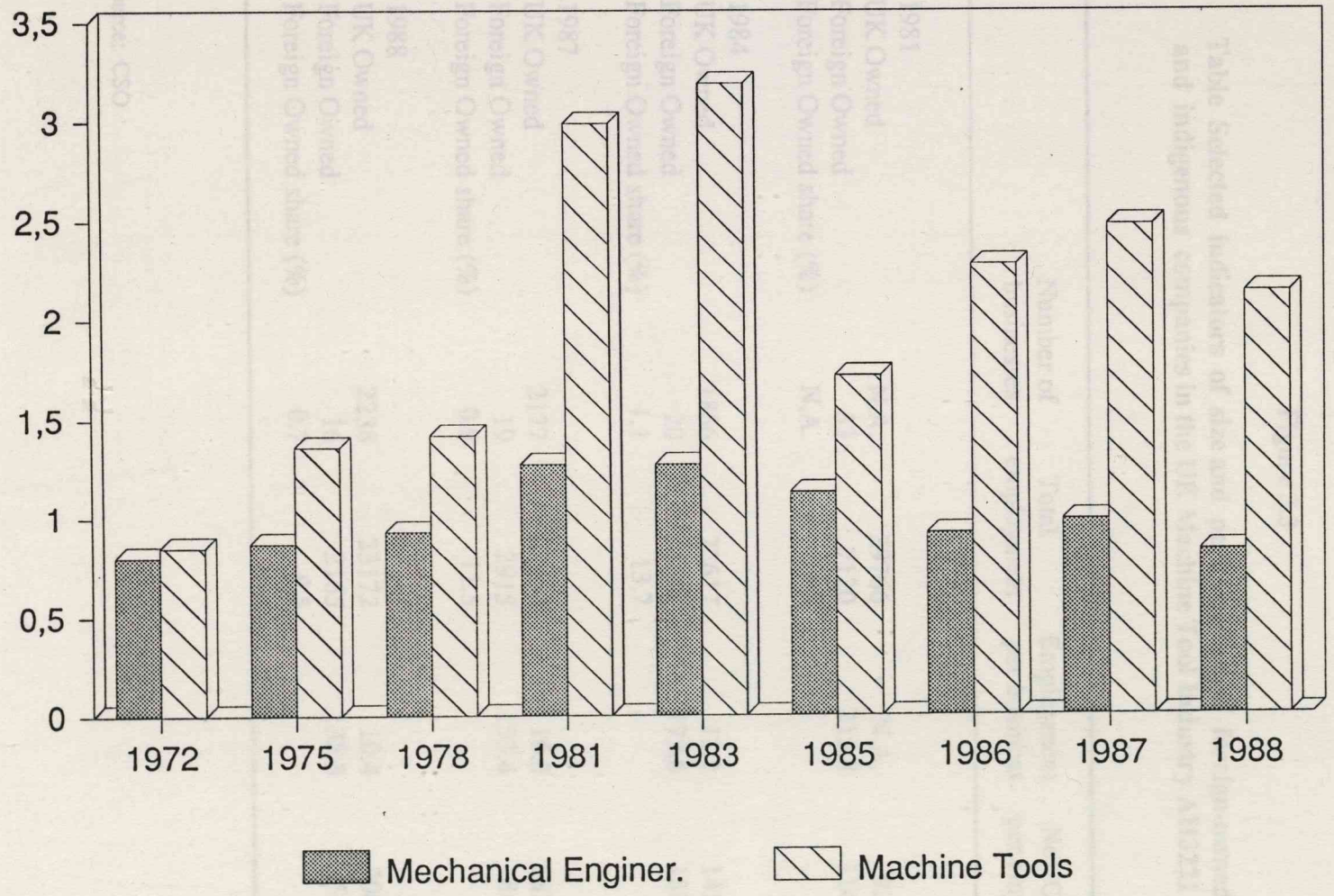
**Percentage of UK Manufacturers sales**

| | 1970 | 1975 | 1980 | 1985 | 1986 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|
| MC Horiz | 1.5 | 1.4 | 2.5 | 9.0 | 6.2 | 7.3 | - |
| MC Vert | - | - | 1.6 | 10.1 | 12.8 | 13.5 | - |
| MC | 1.5 | 1.4 | 4.1 | 19.1 | 18.9 | 20.8 | - |
| CNC Lathe | 1.3 | 2.6 | 6.3 | 10.1 | 9.5 | 13.7 | - |
| NC Total | 8.3 | 8.3 | 17.1 | 42.9 | 47.1 | 63.5 | 60.4 |
| Lathes | 30.2 | 24.4 | 20.8 | 11.2 | 11.1 | 9.3 | 8.0 |
| Transfer | 5.0 | 7.0 | 9.1 | 4.9 | 6.2 | 3.9 | 6.0 |
| Grinding | 13.6 | 11.1 | 12.4 | 7.0 | 9.5 | 2.8 | 2.7 |
| Non NC Cut | 71.4 | 65.0 | 65.0 | 38.5 | 38.9 | 22.7 | 21.4 |
| Non NC Form | 20.3 | 26.7 | 17.9 | 18.6 | 14.0 | 13.9 | 18.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: CSO

Figure 3.2

# R&D / Sales Rations




Source: CSO

Figure 3.2

Source: OECD

**Figure 3.3**

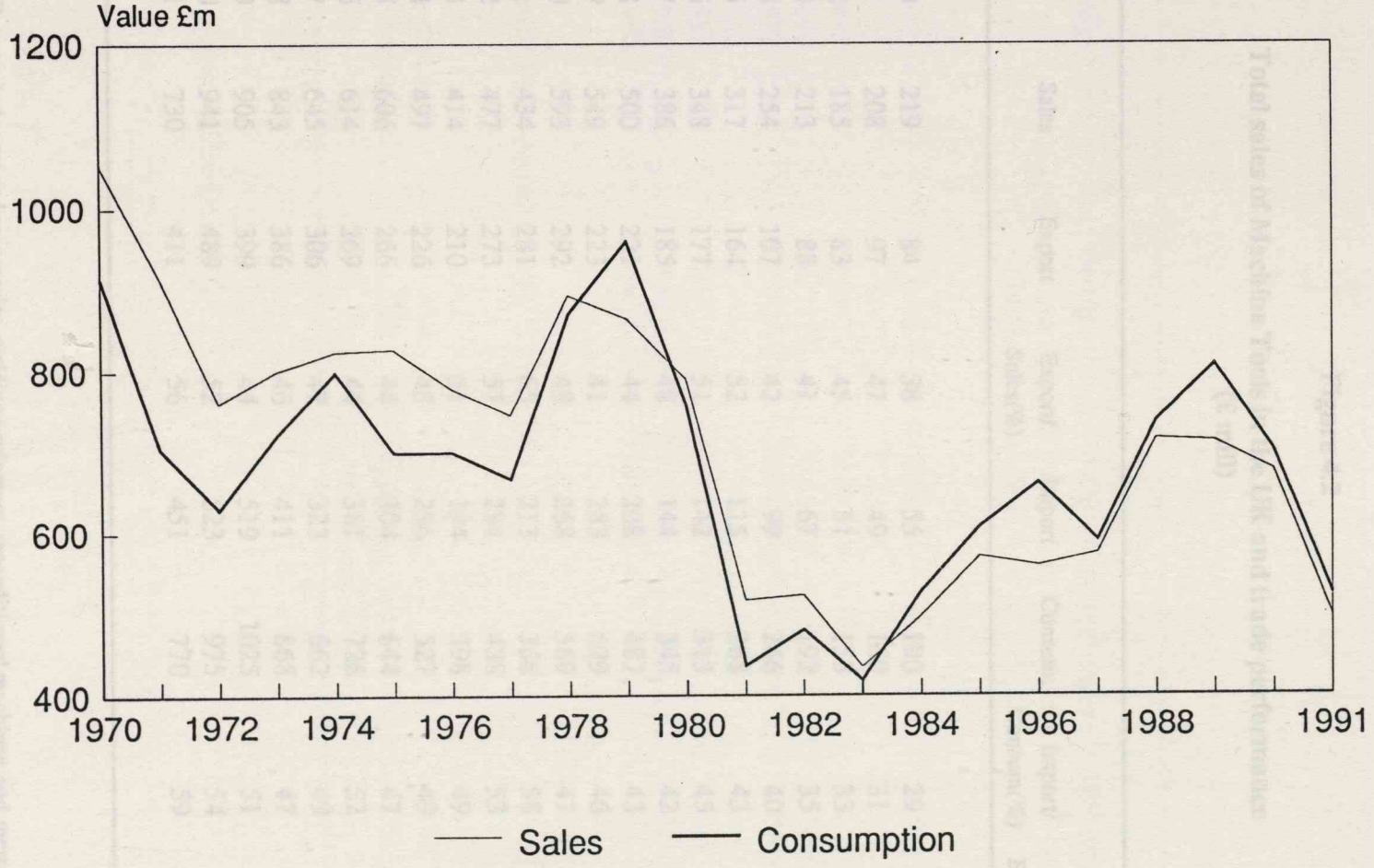
**Table Selected indicators of size and performance of foreign-owned and indigenous companies in the UK Machine Tool Industry AH3221**

| | Number of businesses | Total employment | Employment per business | Net Output per employee |
|---|---|---|---|---|
| 1981 | | | | |
| UK Owned | N.A. | 29766 | N.A. | 9293 |
| Foreign Owned | 33 | 7120 | 215.8 | 11411 |
| Foreign Owned share (%) | N.A. | 19.3 | | |
| 1984 | | | | |
| UK Owned | 1856 | 22617 | 12.2 | 14140 |
| Foreign Owned | 20 | 3591 | 179.6 | 15198 |
| Foreign Owned share (%) | 1.1 | 13.7 | | |
| 1987 | | | | |
| UK Owned | 2177 | 22454 | 10.3 | 18181 |
| Foreign Owned | 19 | 2915 | 153.4 | 18665 |
| Foreign Owned share (%) | 0.9 | 11.5 | | |
| 1988 | | | | |
| UK Owned | 2238 | 23172 | 10.4 | 20080 |
| Foreign Owned | 16 | 2165 | 135.3 | 25849 |
| Foreign Owned share (%) | 0.7 | 8.5 | | |

Source: CSO

Figure 4.1

# Sales and Consumption 1970-91
## UK Machine Tool Industry




Prices adjusted to 1985 RPI

Figure 4.1 Sales and Consumption 1970-91
UK Machine Tool Industry




Prices adjusted to 1985 RPI

## Figure 4.2

### Total sales of Machine Tools in the UK and trade performance (£ mill)

| | Sales | Export | Export/ Sales(%) | Import | Consum. | Import/ Consum(%) | Net Balance |
|---|---|---|---|---|---|---|---|
| 1970 | 219 | 84 | 38 | 55 | 190 | 29 | 29 |
| 1971 | 208 | 97 | 47 | 49 | 160 | 31 | 48 |
| 1972 | 185 | 83 | 45 | 51 | 153 | 33 | 32 |
| 1973 | 213 | 88 | 41 | 67 | 192 | 35 | 21 |
| 1974 | 254 | 107 | 42 | 99 | 246 | 40 | 8 |
| 1975 | 317 | 164 | 52 | 115 | 268 | 43 | 49 |
| 1976 | 348 | 177 | 51 | 142 | 313 | 45 | 35 |
| 1977 | 386 | 185 | 48 | 144 | 345 | 42 | 41 |
| 1978 | 500 | 221 | 44 | 208 | 487 | 43 | 13 |
| 1979 | 549 | 223 | 41 | 283 | 609 | 46 | -60 |
| 1980 | 593 | 292 | 49 | 268 | 569 | 47 | 24 |
| 1981 | 434 | 281 | 65 | 213 | 366 | 58 | 68 |
| 1982 | 477 | 273 | 57 | 234 | 438 | 53 | 39 |
| 1983 | 414 | 210 | 51 | 194 | 398 | 49 | 16 |
| 1984 | 497 | 226 | 45 | 256 | 527 | 49 | -30 |
| 1985 | 606 | 266 | 44 | 304 | 644 | 47 | -38 |
| 1986 | 614 | 269 | 44 | 381 | 726 | 52 | -112 |
| 1987 | 645 | 306 | 47 | 323 | 662 | 49 | -17 |
| 1988 | 843 | 386 | 46 | 411 | 868 | 47 | -25 |
| 1989 | 905 | 399 | 44 | 519 | 1025 | 51 | -120 |
| 1990 | 941 | 489 | 52 | 523 | 975 | 54 | -34 |
| 1991 | 730 | 411 | 56 | 451 | 770 | 59 | -40 |

Note: Data exclude part and accessories, welding equipment, reconditioned machines and merchanded goods. Sales figures are grossed up to reflect incomplete coverage of the sample.

Source: MTTA

Figure 4.2

Total sales of Machine Tools in the UK and trade performance
(£ mill)

| | Sales | Export | Export/ Sales(%) | Import | Consum. | Import/ Consum.(%) | Net Balance |
|---|---|---|---|---|---|---|---|
| 1970 | 219 | 84 | 38 | 53 | 188 | 28 | 31 |
| 1971 | 208 | 97 | 47 | 49 | 160 | 31 | 48 |
| 1972 | 185 | 83 | 45 | 51 | 153 | 33 | 32 |
| 1973 | 213 | 88 | 41 | 67 | 192 | 35 | 21 |
| 1974 | 254 | 107 | 42 | 99 | 246 | 40 | 8 |
| 1975 | 317 | 164 | 52 | 115 | 268 | 43 | 49 |
| 1976 | 348 | 177 | 51 | 142 | 313 | 45 | 36 |
| 1977 | 386 | 185 | 48 | 141 | 345 | 42 | 41 |
| 1978 | 500 | 221 | 44 | 208 | 487 | 43 | 13 |
| 1979 | 549 | 223 | 41 | 283 | 609 | 46 | -60 |
| 1980 | 593 | 202 | 40 | 268 | 589 | 47 | 24 |
| 1981 | 434 | 281 | 65 | 213 | 366 | 58 | 68 |
| 1982 | 477 | 273 | 57 | 234 | 438 | 53 | 39 |
| 1983 | 414 | 210 | 51 | 194 | 398 | 49 | 16 |
| 1984 | 497 | 226 | 45 | 256 | 527 | 49 | -30 |
| 1985 | 606 | 266 | 44 | 304 | 644 | 47 | -38 |
| 1986 | 614 | 269 | 44 | 381 | 726 | 52 | -112 |
| 1987 | 645 | 306 | 47 | 323 | 662 | 49 | -17 |
| 1988 | 843 | 386 | 46 | 411 | 808 | 47 | -25 |
| 1989 | 905 | 399 | 44 | 519 | 1025 | 51 | -120 |
| 1990 | 941 | 489 | 52 | 523 | 975 | 54 | -34 |
| 1991 | 730 | 411 | 56 | 451 | 770 | 59 | -40 |

Note: Data exclude part and accessories, welding equipment, reconditioned machines and merchanded goods. Sales figures are grossed up to reflect the sample coverage of the survey.

Source: MTTA

**Figure 4.3**

**Table UK Machine Tool Industry relative performance**

| Year | World Production ($mn) | World Exports ($mn) | UK Share of Production % | UK Share of Exports % |
|---|---|---|---|---|
| 1965 | 8411 | 1580 | 8.2 | 7.5 |
| 1971 | 7843 | 2935 | 5.9 | 8.1 |
| 1975 | 13644 | 5897 | 5.3 | 6.1 |
| 1979 | 22919 | 9660 | 4.9 | 4.9 |
| 1983 | 19530 | 8393 | 3.1 | 3.8 |
| 1987 | 31300 | 14700 | 3.0 | 3.4 |
| 1988 | 37935 | 17260 | 3.9 | 4.0 |
| 1989 | 42474 | 19216 | 3.8 | 3.4 |
| 1990 | 46583 | 21874 | 3.7 | 3.8 |
| **Growth in production/trade** | | | | |
| 1990/1971 | 594 | 745 | 372 | 350 |
| 1990/1965 | 968 | 1348 | 437 | 683 |

Source: American Machinist, NMTBA

## Figure 4.4

### MACHINE TOOL EXPORTS BY MAJOR DESTINATIONS

| 1980 | | | 1990 | | |
|---|---|---|---|---|---|
| | £ mil | % | | £ mil | % |
| ALL COUNTRIES | 289.8 | 100.0 | ALL COUNTRIES | 489.5 | 100.0 |
| EEC | 75 | 25.9 | EEC | 236.4 | 48.3 |
| USA | 58 | 20.0 | USA | 76.7 | 15.7 |
| W. GERMANY | 25.3 | 8.7 | W GERMANY | 74.7 | 15.3 |
| SOUTH AFRICA | 20.6 | 7.1 | BELGIUM | 48 | 9.8 |
| FRANCE | 16.3 | 5.6 | FRANCE | 39.9 | 8.2 |
| ITALY | 12.4 | 4.3 | ITALY | 25.1 | 5.1 |
| CANADA | 10.8 | 3.7 | USSR | 18.3 | 3.7 |
| SWITZWERLAND | 10.6 | 3.7 | SWEDEN | 16 | 3.3 |
| IRISH REPUBLIC | 10.3 | 3.6 | IRISH REPUBLIC | 12.6 | 2.6 |
| MEXICO | 8.8 | 3.0 | SPAIN | 12.1 | 2.5 |
| USSR | 8.3 | 2.9 | NETHERLANDS | 11 | 2.2 |
| INDIA | 6.8 | 2.3 | SWITZERLAND | 10.5 | 2.1 |
| SWEDEN | 6.6 | 2.3 | SOUTH AFRICA | 9.3 | 1.9 |

### MACHINE TOOL IMPORTS BY MAJOR SOURCES

| 1980 | | | 1990 | | |
|---|---|---|---|---|---|
| | £ mil | % | | £ mil | % |
| ALL COUNTRIES | 267.5 | 100.0 | ALL COUNTRIES | 522.7 | 100.0 |
| EEC | 127.2 | 47.6 | EEC | 211.7 | 40.5 |
| W GERMANY | 78.7 | 29.4 | W GERMANY | 134.4 | 25.7 |
| USA | 43.5 | 16.3 | JAPAN | 119.6 | 22.9 |
| JAPAN | 33.5 | 12.5 | USA | 73.5 | 14.1 |
| SWITZERLAND | 24 | 9.0 | SWITZERLAND | 31 | 5.9 |
| ITALY | 22.7 | 8.5 | ITALY | 28 | 5.4 |
| FRANCE | 10.9 | 4.1 | CANADA | 24.8 | 4.7 |
| SWEDEN | 8.5 | 3.2 | TAIWAN | 19 | 3.6 |
| SPAIN | 8 | 3.0 | FRANCE | 18 | 3.4 |
| NETHERLANDS | 5.7 | 2.1 | SWEDEN | 11.4 | 2.2 |
| AUSTRIA | 4.2 | 1.6 | BELGIUM | 10.4 | 2.0 |
| BELGIUM | 4.2 | 1.6 | SPAIN | 7.2 | 1.4 |
| DENMARK | 3.2 | 1.2 | NETHERLANDS | 6.5 | 1.2 |

Source: HM Customs and Excise

Figure 4.4

MACHINE TOOL EXPORTS BY MAJOR DESTINATIONS

| | 1980 | | | 1990 | |
|---|---|---|---|---|---|
| | £ mill | % | | £ mill | % |
| ALL COUNTRIES | 289.8 | 100.0 | ALL COUNTRIES | 480.5 | 100.0 |
| EEC | 75 | 25.9 | EEC | 236.4 | 49.2 |
| USA | 58 | 20.0 | USA | 76.7 | 15.7 |
| W. GERMANY | 25.3 | 8.7 | W GERMANY | 74.7 | 15.3 |
| SOUTH AFRICA | 20.6 | 7.1 | BELGIUM | 48 | 9.8 |
| FRANCE | 16.3 | 5.6 | FRANCE | 39.9 | 8.2 |
| ITALY | 12.4 | 4.3 | ITALY | 25.1 | 5.1 |
| CANADA | 10.8 | 3.7 | USSR | 16.2 | 3.7 |
| SWITZWERLAND | 10.6 | 3.7 | SWEDEN | 16 | 3.3 |
| IRISH REPUBLIC | 10.3 | 3.6 | IRISH REPUBLIC | 12.6 | 2.6 |
| MEXICO | 8.8 | 3.0 | SPAIN | 12.1 | 2.5 |
| USSR | 8.3 | 2.9 | NETHERLANDS | 11 | 2.2 |
| INDIA | 6.8 | 2.3 | SWITZERLAND | 10.5 | 2.1 |
| SWEDEN | 6.6 | 2.3 | SOUTH AFRICA | 9.3 | 1.9 |

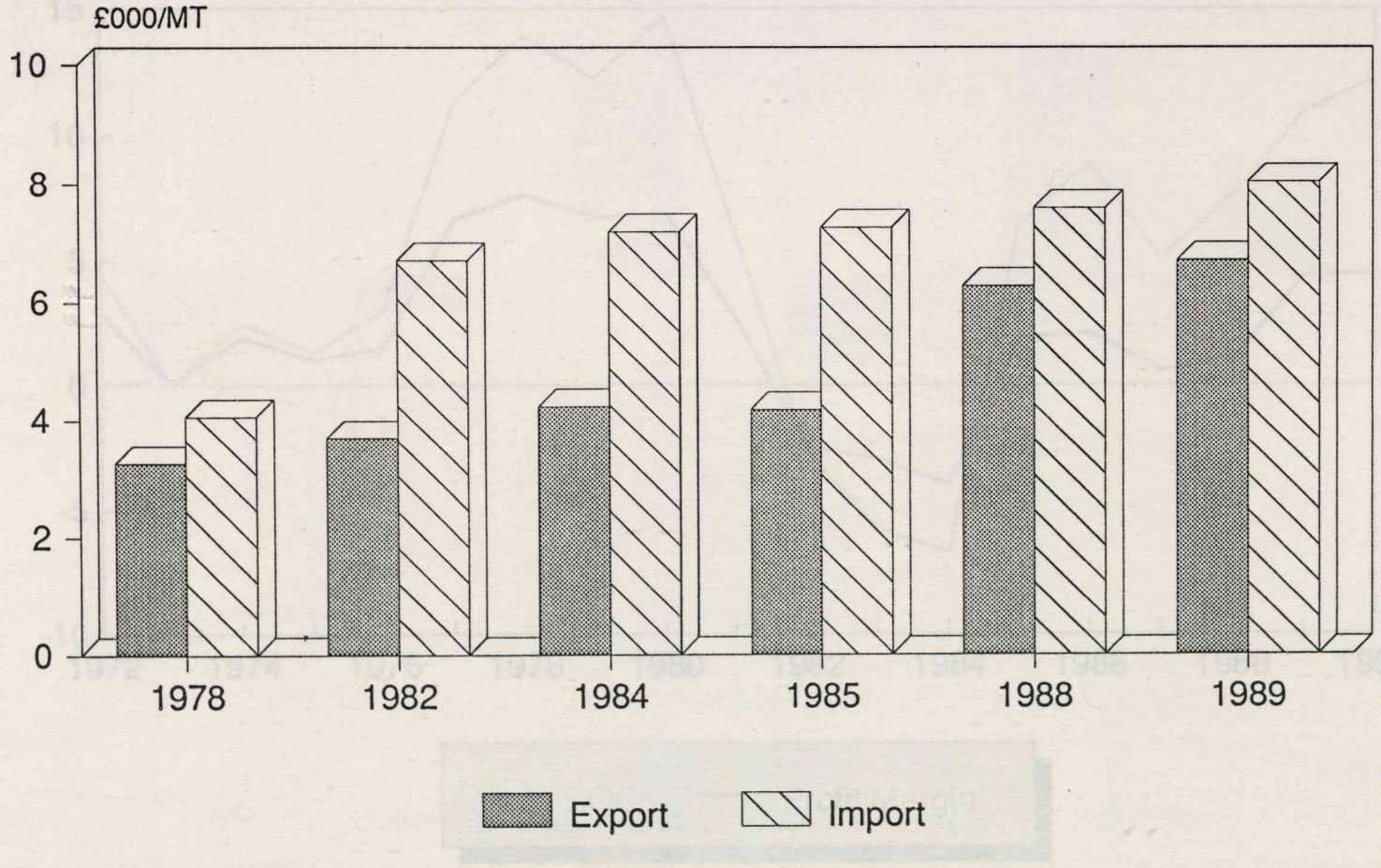
MACHINE TOOL IMPORTS BY MAJOR SOURCES

| | 1980 | | | 1990 | |
|---|---|---|---|---|---|
| | £ mil | % | | £ mil | % |
| ALL COUNTRIES | 267.5 | 100.0 | ALL COUNTRIES | 522.7 | 100.0 |
| EEC | 127.2 | 47.6 | EEC | 211.7 | 40.5 |
| W GERMANY | 78.7 | 29.4 | W GERMANY | 134.4 | 25.7 |
| USA | 43.5 | 16.3 | JAPAN | 119.6 | 22.9 |
| JAPAN | 33.5 | 12.5 | USA | 73.5 | 14.1 |
| SWITZERLAND | 24 | 9.0 | SWITZERLAND | 31 | 5.9 |
| ITALY | 22.7 | 8.5 | ITALY | 28 | 5.4 |
| FRANCE | 10.9 | 4.1 | CANADA | 24.8 | 4.7 |
| SWEDEN | 8.5 | 3.2 | TAIWAN | 19 | 3.6 |
| SPAIN | 8 | 3.0 | FRANCE | 18 | 3.4 |
| NETHERLANDS | 5.7 | 2.1 | SWEDEN | 11.4 | 2.2 |
| AUSTRIA | 4.2 | 1.6 | BELGIUM | 10.4 | 2.0 |
| BELGIUM | 4.2 | 1.6 | SPAIN | 7.2 | 1.4 |
| DENMARK | 3.2 | 1.2 | NETHERLANDS | 6.5 | 1.2 |

Source: HM Customs and Excise

Figure 4.5

# Value/Weight Ratio of Exports & Imports
## UK Machine Tool Industry
(Selected Years)

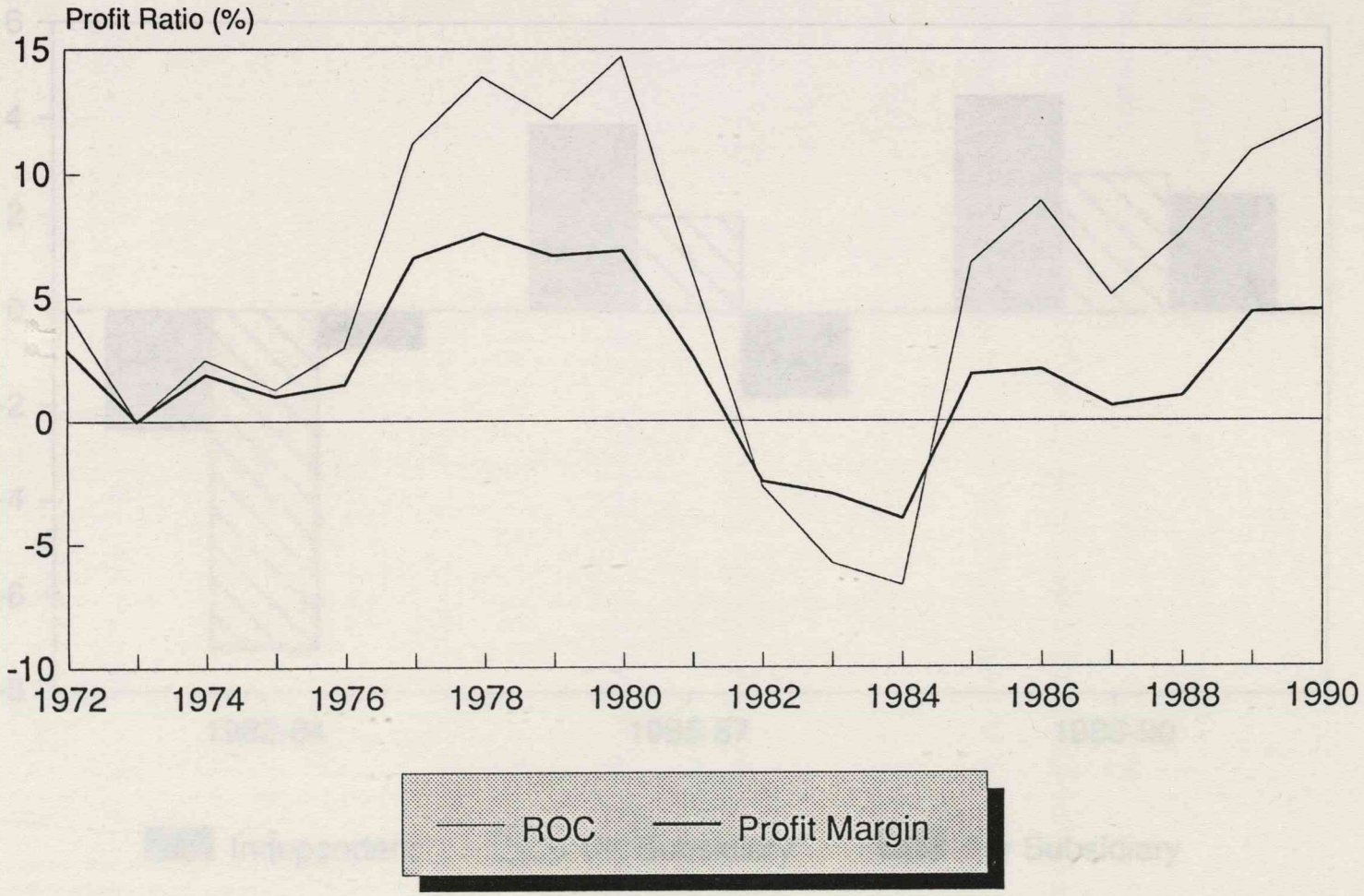



Source: Overseas Trade Statistics

£000MT
10
8
6
4
2
0
1970
1975
1980
1985
1990
Export
Import

Figure 4.6

# Profitability in UK Machine Tools 1972-90




Source: ICC

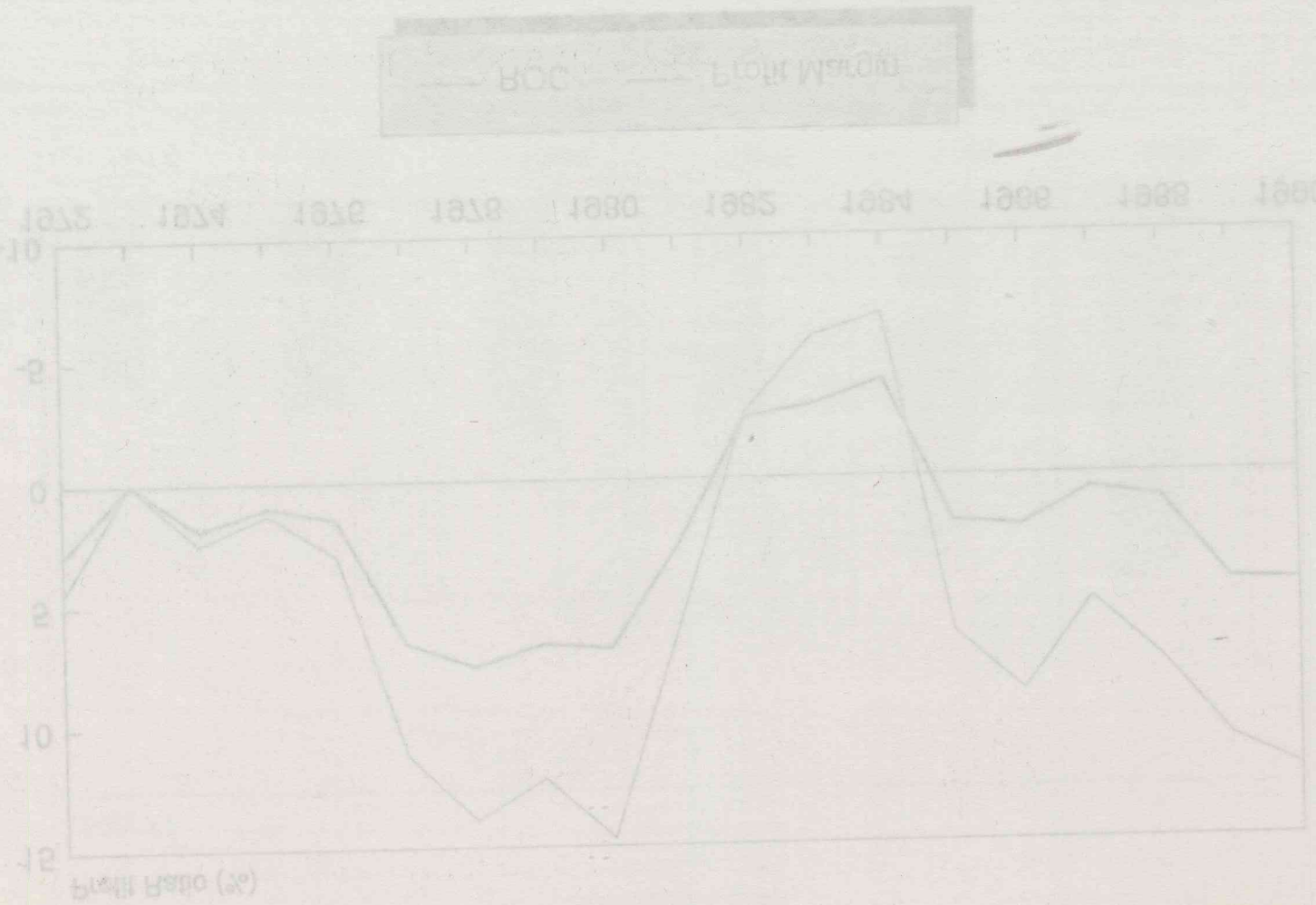
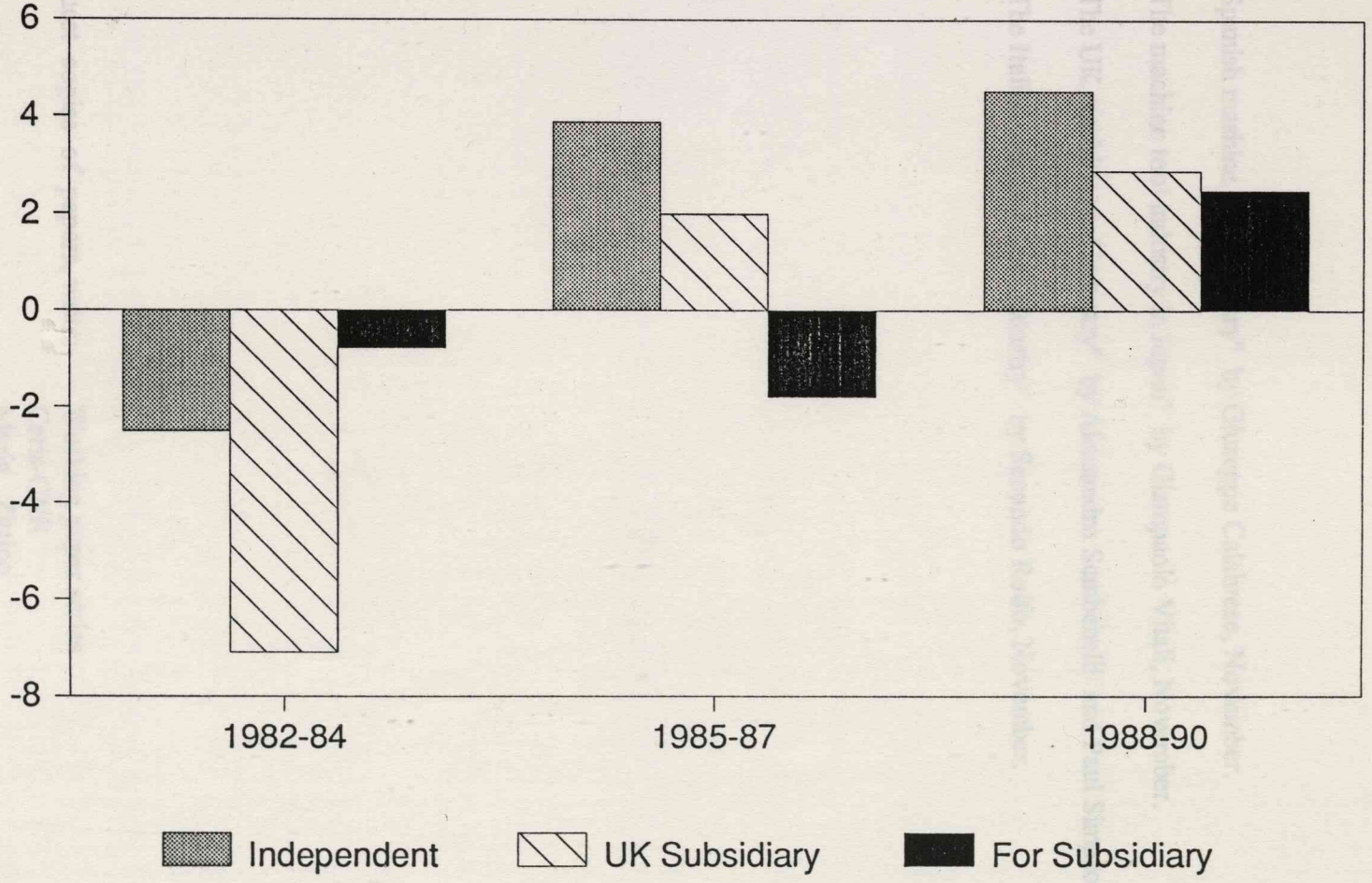
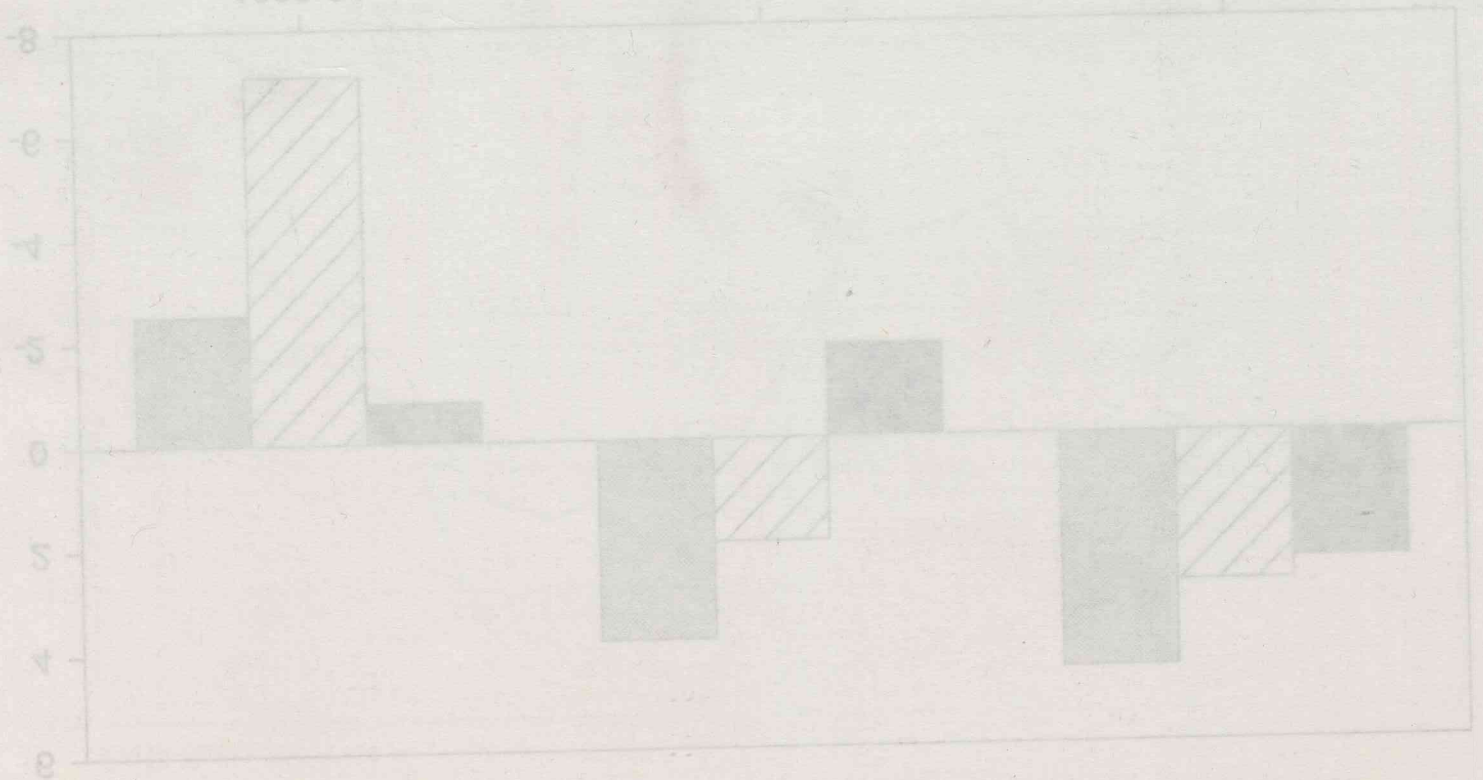

Profit Ratio (%)
-10
-5
0
5
10
15

Figure 4.7

## Profit Ratios by Ownerhip and Size (Profit Margin %)




Source: ICC



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